E3 THE E CUBED COMPANY, L.L.C.

Providers of Strategic Energy Services At The Exponential Interface Among

- Energy
- Economics and
- Environment

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October 15, 2008
Philip Giudice, Commissioner
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Re: Comments – AEPS

Dear Commissioner Giudice:

Thank you for the opportunity to comment on the propositions outlined.

The E Cubed Company, LLC is filing comments on behalf the Joint Supporters[1], a voluntary association of providers and users of distributed generation technology and systems (combined heat and power), demand response technology and services, and energy efficiency technology and services. Our comments here focus on combined heat and power, especially Micro-Combined Heat and Power Technology (Micro-CHP), and micro-turbine technology.

The comments are also being filed specifically on behalf of ECR International, Inc. and Climate Energy, LLC, Medfield, Massachusetts, manufacturers and developers of a Micro-Combined Heat and Power Technology (Micro-CHP) being commercialized under the mark of freewatt®. They are also filed on behalf of Capstone Turbine Corporation, manufacturers of modular micro-turbine systems.

Due to new technology CHP now has the ability to be micro-sized for the residential market and modular-sized for the commercial building marketplaces. Both are capable of being net metered and being aggregated to participate as auxiliary resources for grid reliability purposes of ISO-New England. Societal

[1] The Joint Supporters were active in Massachusetts DG Collaborative from 2002-2006 addressing standardization of interconnection and other procedures to facilitate deployment of distributed generation regardless of fuel source. They have participated and commented with respect to the role of CHP in Alternative Energy Portfolio or related proceedings in multiple recent regulatory and policy proceedings in Massachusetts, ISO-New England (Forward Capacity Market), Rhode Island (DG Work Group), Connecticut (Implementation of 2005 Energy Independence Act), Vermont (Legislative Reform), New York (Energy Efficiency Portfolio Proceeding), and Pennsylvania (Alternative Energy Portfolio Act of 2004).

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fuel savings and emissions reductions can be substantial with micro-CHP and micro-turbines.

The efficiency potential of smaller systems, including residential CHP, has been recognized in Massachusetts where the Green Communities Act established various incentives for CHP with an energy efficiency of 60% or above and defined micro-CHP as 60 kW and below. Both Massachusetts and Vermont encourage micro-CHP utilizing natural gas as part of their renewable and energy efficiency portfolio programs.

The inclusion of DG/CHP systems in Alternate Energy Portfolios for reducing future peak and energy needs has also been recognized in Connecticut, New Jersey, Pennsylvania, and California.

Congress, as part of the Recovery and Tax Credit Act signed by President Bush on October 3, 2008 sets a 10% business tax credit for CHP less than 15,000 kW in size (through December 31, 2016) as well as increased tax credits for micro-turbines and fuel cells. This is expected to provide a stimulus for investment in CHP in Massachusetts during the APS horizon between now until 2020. Congress has yet to act on an individual tax credit for residential CHP. The State should act to capitalize on this leverage. Setting aggressive goals in the APS is an important task.

The APS provisions target a 25% source share for demand side resources by 2020 for behind the meter combined heat and power, energy efficiency, demand response, and load management. (SECTION 116. (a) (1))

- **How should the Annual APS percentage rate be determined, and what should that rate be?**

It is not clear what the base percentage is at the present time. The incremental change rate to the 25% should scale gradually upward rather than be set as a flat percentage from the outset in order to permit commercialization activities to ramp up, especially with smaller technologies, such as Micro-CHP.

Assume that the current base is 3% and the goal is 25% by 2020, a time interval of eleven years. It would be easy to prescribe an equal 2% per year objective (22% divided by eleven years equals 2% per year.) A more appropriate strategy to preserve opportunity for smaller systems and sites would be to start lower say perhaps 1% in yr. 1, 1.5% in yr. 2, and so on adding 0.5 % per year to the ramp rate peaking in mid-life and tapering down.

This approach should not be allowed to diminish incentives that become available from various sources. Indeed incentives for specific measures should be allowed to increase over time to keep pace with selected measure costs.

Why preserve opportunity for smaller sites? Historically, CHP experienced a clear marketplace desire trending toward larger systems. Given the extensive opportunity to offer highly efficient "green" systems to the large quantity of residents that live in 1-4 family homes, the State should set targets that recognize that smaller systems have exceptional financial difficulty due to a disproportional burden of costs which do not scale linearly with size (e.g., project marketing/sales to customer, engineering design).

To specifically address this marketplace hurdle, the Massachusetts Technology Trust and/or the utilities should create a "CHP Fleet" program geared toward smaller-scale projects that has a built-in mechanism to specifically address these disproportional cost burdens. Adequate time is needed to scale-up the influence of the CHP Fleet program, especially how it may function as a "feeder" program to secure initial customer participation then direct that customer to other CHP programs for follow-on opportunities.

- **What criteria should be required for any of the specified eligible technologies or fuels?**

Behind the meter CHP should be encouraged if it reduces overall societal fossil fuel consumption compared to on-site thermal generation and remote central station generation individually. Also it should be encouraged if it produces lower emissions than the average central fossil plant emissions in Massachusetts (or ISO-New England) whichever is lower and has average annual efficiency of 60% or higher. (See comments below on emissions)

Ready analyses of Btu consumption and Btu benefits can be performed for "educational purposes" employing EPA's CHP Emissions calculator available at: http://www.epa.gov/chp/basic/calculator.html

Societal energy savings and emissions results are discussed below.

Micro-CHP, utilizing natural gas or propane, offers many benefits to both individual ratepayers who use such systems and to ratepayers overall, particularly in constrained areas. These benefits include mitigation of increased electric costs, improvements in system reliability, congestion relief, and most important, micro-CHP can assist in reducing societal fuel consumption and reducing emissions of key pollutants, such as NOx, SO2, and CO2.

The climb to an 80% efficiency standard for new systems by 2020 as required by the Act should not be done incrementally year by year because that is totally disruptive of technology diffusion processes, which normally allows a standard to set in place for a period of years, before moving to another. We may suggest schedules in formal comments later.

- **What should the Alternative Compliance Payment (ACP) amount be for APS, and how should it be calculated?**

[No comment]

- **What criteria should be applied to emission performance standards and permanent CO2 sequestration standards as referenced in the Act?**

The attached "Appendix A" illustrates the fuel consumption and emissions benefits that could be achieved from the installation of a fleet of 1,000 freewatt® units (@ 1.2 kW) in Massachusetts. The results, which were achieved using the new US EPA CHP emissions calculator, show the following reductions:

1. 32% reduction in societal fuel consumption (35,742 MMBTu/Yr) compared to US average central power plant fossil fuel consumption and on-site thermal consumption.
2. 76% reduction in NOx emissions (4.98 tons/Yr).
3. 100% reduction in SO2 emissions (11.33 tons/Yr).
4. 40% reduction in CO2 emissions (3,015tons/Yr).
5. 40% reduction in Carbon emissions (745 metric tons/Yr)

The reduction in CO2 is equivalent to removing 498 passenger vehicles from the road or the amount of carbon that can be stored annually in 621 acres of pine and fir forest.

These illustrative results suggest that objectives can be set to reduce societal fuel consumption and emissions utilizing combined heat and power even at the level of the residential household. Similar analyses can be performed for other CHP systems. However, this illustration is provided only for educational and informational purposes.

In this example, each micro-CHP unit avoids three tons of CO2 emissions per year equal to removing a passenger vehicle from Massachusetts's roads for six months and avoiding the need to sequester carbon in 0.6 acres of pine and fir forest.

- **What specific means of monitoring and verification will be necessary for compliance with the APS regulation?**

[No comment at this time]

We welcome further inquiry or dialogue with interested parties and officials.

Very Truly Yours,

Ruben S. Brown, M.A.L.D.
President, The E Cubed Company, L.LC.

On behalf of the Joint Supporters, Climate Energy, LLC, ECR International, Inc., and Capstone Turbine Corporation.

Encl:

cc. Arthur Pearson,
Eric Dubin, ECR International, Inc. & Climate Energy, LLC
Justin Rathke, Capstone Turbine Corporation

Appendix A

CHP Results

The results generated by the CHP Emissions Calculator are intended for eductional and outreach purposes only; it is not designed for use in developing emission inventories or preparing air permit applications.

Annual Emissions Analysis					
	CHP System	Displaced Electricity Production	Displaced Thermal Production	Emissions/Fuel Reduction	Percent Reduction
NOx (tons/year)	1.54	3.39	3.12	4.98	76%
SO2 (tons/year)	0.02	11.33	0.02	11.33	100%
CO2 (tons/year)	4,530	3,896	3,649	3,015	40%
Carbon (metric tons/year)	1,120	963	902	745	40%
Fuel Consumption (MMBtu/year)	77,444	50,804	62,382	35,742	32%
Equivalent Acres of Pine and Fir Forests				621	
Equivalent Passenger Vehicles				498	

This CHP project will reduce emissions of Carbon Dioxide (CO_2) by 3,015 tons per year

This is equal to 745 metric tons of carbon equivalent (MTCE) per year

This reduction is equal to the annual carbon stored by 621 acres of pine and fir forests

OR

This reduction is equal to the carbon emissions of 498 passenger vehicles per year

Appendix A

CHP Results

CHP Technology:	Recip Engine - Rich Burn	
Fuel:	Natural Gas	
Unit Capacity:	1	kW
Number of Units:	1,000	
Total CHP Capacity:	1,200	kW
Operation:	4,160	hours per year
Heat Rate:	15,514	Btu/kWh HHV
CHP Fuel Consumption:	77,444	MMBtu/year
Duct Burner Fuel Consumption:	-	MMBtu/year
Total Fuel Consumption:	**77,444**	**MMBtu/year**
Total CHP Generation:	**4,992**	**MWh/year**
Useful CHP Thermal Output:	49,906	MMBtu/year for thermal applications (non-cooling)
	-	MMBtu/year for electric applications (cooling and electric heating)
	49,906	**MMBtu/year Total**
Displaced On-Site Production for		Existing Gas Boiler
Thermal (non-cooling) Applications:	0.10	lb/MMBtu NOx
	0.00%	sulfur content
Displaced Electric Service (cooling and electric heating):		
	There is no displaced cooling service	
Displaced Electricity Profile:	eGRID Average Fossil 2004	
Egrid State:	MA	
Distribution Losses:	7%	
Displaced Electricity Production:	4,992	MWh/year CHP generation
	-	MWh/year Displaced Electric Demand (cooling)
	-	MWh/year Displaced Electric Demand (electric heating)
	349	MWh/year Transmission Losses
	5,341	**MWh/year Total**

Appendix A

CHP Results

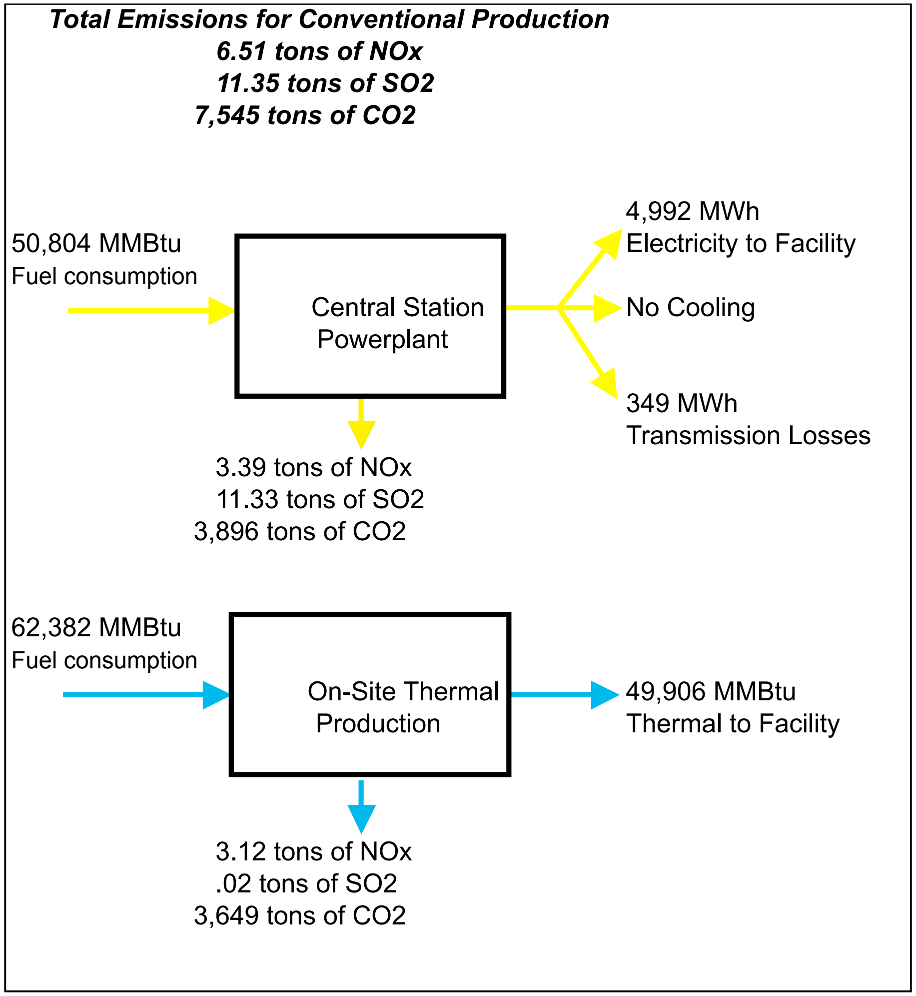
Annual Analysis for CHP				
	CHP System: Recip Engine - Rich Burn			Total Emissions from CHP System
NOx (tons/year)	1.54	-		1.54
SO2 (tons/year)	0.02	-		0.02
CO2 (tons/year)	4,530	-		4,530
Carbon (metric tons/year)	1,120	-		1,120
Fuel Consumption (MMBtu/year)	77,444	-		77,444

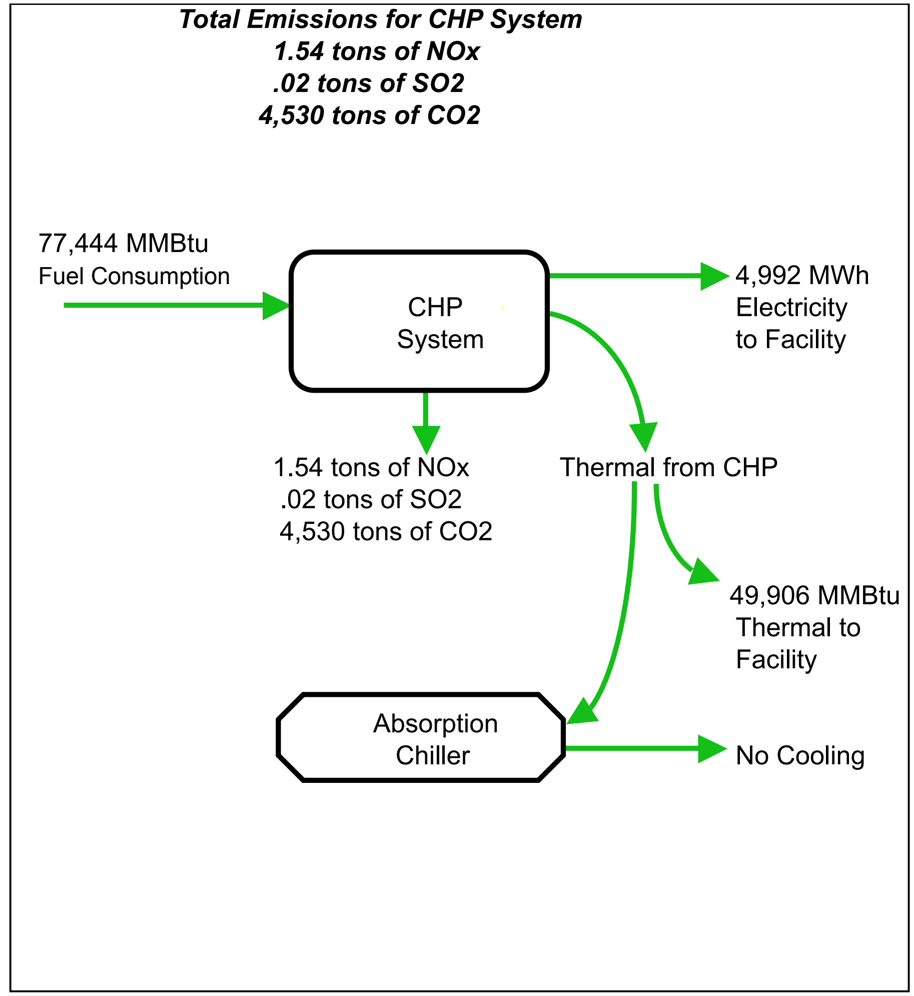
Annual Analysis for Displaced Production for Thermal (non-cooling) Applications				
				Total Displaced Emissions from Thermal Production
NOx (tons/year)				3.12
SO2 (tons/year)				0.02
CO2 (tons/year)				3,649
Carbon (metric tons/year)				902
Fuel Consumption (MMBtu/year)				62,382

Annual Analysis for Displaced Electricity Production					
	Displaced CHP Electricity Generation	Displaced Electricity for Cooling	Displaced Electricity for Heating	Transmission Losses	Total Displaced Emissions from Electricity Generation
NOx (tons/year)	3.17	-	-	0.22	3.39
SO2 (tons/year)	10.59	-	-	0.74	11.33
CO2 (tons/year)	3,641	-	-	254.86	3,896
Carbon (metric tons/year)	900	-	-	63	963
Fuel Consumption (MMBtu/year)	47,480	-	-	3,324	50,804

Appendix A

CHP Results





Appendix A

CHP Results

Emission Rates			
	CHP System including Duct Burners	Recip Engine - Rich Burn Alone	Displaced Electricity
NOx (lb/MWh)	0.62	0.62	1.27
SO2 (lb/MWh)	0.01	0.01	4.24
CO2 (lb/MWh)	1,815	1,815	1,459

Emission Rates	
	Displaced Thermal Production
NOx (lb/MMBtu)	0.10
SO2 (lb/MMBtu)	0.00059
CO2 (lb/MMBtu)	117